

ON THE REALITY OF TOOTH FAIRIES: A REVIEW OF THE GOD DELUSION.

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In *The God Delusion*, Richard Dawkins reviews the evidence for and against God. After considering arguments for a divine power, he says the main current one is that the characteristics of living creatures must be attributed to an all-powerful designer. Design is the only plausible account, because the excellent fit between each plant and animal and its environment could not possibly have appeared in one stroke by pure chance. Dawkins agrees that randomness could not have done the job, but he says that a designer is equally unlikely. The only viable explanation is evolution by natural selection, a process that operates without plan or design. He then turns to the adaptive value of religious belief. After failing to find any, he proposes that belief in divinities is the by-product of a powerful tendency to learn from others, an adaptive strategy produced by natural selection. Adults and other influential figures teach children many useful things, but they also train them to worship deities. Religious devotion is established through education, and it is maintained over generations by the social learning processes underlying all instances of cultural evolution. Dawkins' arguments together with other problems encountered in describing evolutionary processes highlight the importance of social learning. His discussion leads the reviewer to assert that only by knowing the mechanisms of social learning is it possible to understand how biological and cultural evolution interact to produce life as we find it.

Key words: God theory, natural selection, social learning, cultural evolution, altruism, Dawkins

What? Still another review of Richard Dawkins' *The God Delusion*? The present assessment is motivated by the relevance of what he says to the focus of this Journal. Whereas many evolutionists emphasize a genetic determination of behavior, Dawkins argues for individual experiences as the reason for the widespread belief in God. He invokes basic principles of scientific evolutionary theory to support the idea that deities are man-made delusions sustained through education. The religion he refers to most often is Christianity, but his discussion is about *any* belief system involving supernatural deities. After summarizing Dawkins' arguments, I will discuss some broader implications of his hypotheses.

THE GOD THEORY

Dawkins' provocative stance appears immediately. Here is his dedication: "To the first openly atheist President of the United States—in the tradition of the founding fathers." This sets the tone for what follows. Some readers might be startled by the implication that not all of America's Founding Fathers were committed either to a Christian God or to

Christianity itself when they established their country. Try to guess who said the following:

A. Shake off all the fears of servile prejudices, under which weak minds are servilely crouched. Fix reason firmly in her seat, and call on her tribunal for every fact, every opinion. Question with boldness even the existence of a God; because, if there be one, he must more approve of the homage of reason than that of blindfolded fear.

B. During almost fifteen centuries has the legal establishment of Christianity been on trial. What has been its fruits? More or less, in all places, pride and indolence in the clergy; ignorance and servility in the laity; in both, superstition, bigotry and persecution.

C. Lighthouses are more useful than churches.

D. To talk of immaterial existences is to talk of *nothings*. To say that the human soul, angels, god, are immaterial, is to say they are nothings, or that there is no god, no angels, no soul... I am satisfied, and sufficiently occupied with the things which are, without tormenting or troubling me about those which may indeed be, but of which I have no evidence.

E. This would be the best of all possible worlds, if there were no religion in it.

F. The day will come when the mystical generation of Jesus, by the Supreme Being as his father, in the womb of a virgin, will be

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classed with the fable of the generation of Minerva in the brain of Jupiter.

G. No, I don't know that atheists should be considered as citizens, nor should they be considered patriots. This is one nation under God.

The answers: A. Thomas Jefferson; B. James Madison; C. Benjamin Franklin; D. Thomas Jefferson; E. John Adams; F. John Adams; G. George Bush, Sr. (a father, even if not a founder of the nation). These quotations taken from *The God Delusion* show unequivocally that at least these major founding fathers (of the U.S.) never intended America to be based on Christianity or a belief in God. Incidentally, neither did the Pledge of Allegiance contain any reference to God until the mid 20th century. Our forefathers would not have approved of editing the Pledge to include "under God." They surely would have reacted against a President of the United States trying to legislate religious belief as a criterion for citizenship.

Dawkins describes the various shades of religious belief as follows. *Theism*: belief in a supernatural intelligence who, after creating the universe, continues to oversee the present and future. Some theists believe that God is intimately involved with every individual and intervenes in the world. *Deism*: the belief that a supernatural God set up the laws that govern the universe, but takes no interest in human affairs. *Pantheism*: God is a nonsupernatural name for the laws of Nature and the Universe.

Deists differ from theists in that their God does not answer prayers, is not interested in sins or confessions, does not read our thoughts, and does not intervene with capricious miracles. Deists differ from pantheists in that the deist God is some kind of cosmic intelligence, rather than the pantheist's metaphoric or poetic synonym for the laws of the universe. Pantheism is sexed-up atheism. Deism is watered-down theism. (pp. 7-8)

Atheists, of course, have no use for any references to God, be they literal or metaphoric. After careful consideration of several lines of evidence used to prove a deity, Dawkins concludes that the probability of a supernatural power existing in any form is so small as to approach zero.

The ground rule for approaching this book is simple: Belief in divinities is unwarranted. We know Dawkins as evolutionary biologist

and talented writer; however, neither skill qualifies him as expert on the existence of divinities. But what makes anyone an authority on this issue? What Dawkins has done is thought and read and talked a lot with other people, and he has arrived at certain conclusions. He would be the first to dismiss the notion that being professional in any field makes one's opinion about the reality of a divinity particularly noteworthy. That includes theologians, philosophers, scientists (including evolutionary biologists), musicians, writers, politicians, or anyone else.

A recent debate in *The New York Review of Books* (Dennett & Orr, 2007) between philosopher Daniel C. Dennett and biologist H. Allen Orr illustrates the point. Orr claimed in his review that Dawkins is naïve about religious philosophy; Dennett has little use for Orr's arguments. Orr maintained that Dawkins' discussion of God theory is lowbrow and uninformed about the best in religious philosophical writing, whereas Dennett thinks that Dawkins did an excellent job of taking apart the standard arguments for the existence of higher powers. I will leave the fine points of theology to these writers, one of whom is a professional philosopher. My personal view is that no matter how thoughtful, subtle, or logically coherent the analysis pro or con might be, nobody can prove or disprove the existence or nonexistence of a Christian or any other form of divinity. All the reading I have done has revealed no evidence to the contrary.

What Dawkins shows is why at least some nonbelievers ridicule any commitment to the self-evident existence of a higher being, why nonbelievers find meaningless the miracles devout people claim to have seen, read about, or heard of no matter how plausible they might seem to someone else, and why arguments used to prove the existence of an all-powerful deity are unconvincing to those who reject knowledge based on revelation or faith. His arguments may not be at the cutting edge of religious philosophy, but they do deal with a substantial set of common religious beliefs.

Dawkins' use of biological thinking to challenge a major current argument for the existence of a supernatural divinity is unique. Dawkins finds the idea of intelligent design in nature as a last desperate attempt to prove the reality of an all-powerful God. The odds of any complex living structure having appeared

strictly by chance are vanishingly small. Dawkins cites Fred Hoyle as the father of the metaphor that life forms being the product of random processes are as likely as the notion that a hurricane might tumble and connect enough elements to yield a Boeing 747. That metaphor will be familiar to those who have read *The Blind Watchmaker* (Dawkins, 1986): Chance cannot be the agent responsible for the excellent fit of life forms to their particular environment. Because every animal and plant species has whatever it takes to live in its environment, each must have been designed to fit. A design requires a designer, and the designer is God. Therefore, God exists.

Dawkins agrees that the idea of the living world being the product of sheer randomness is ridiculous. The multitude of highly organized living systems could not possibly have appeared by chance alone. What he does next is turn the creationists' argument from improbability back against them. When people assert that God must exist as the intelligent designer of complex living systems, they have done no more than offer another total improbability as their explanation of both simple and complex life forms. God-as-designer rivals pure chance as an implausible explanation of the fit between every species and its environment. The appearance of striking patterns in nature does not require a higher being as designer. Saying that life forms require an all-powerful Creator is an argument from ignorance.

So how did the properties of living systems come about? Richard Dawkins, the expert evolutionary biologist and theorist, now sheds the mask of polemical atheist and starts talking about the only truly believable, nonmystical explanation of life forms. Darwinian natural selection is the answer. Natural selection, operating totally without a goal, has crafted organized complexity step-by-step from earlier forms purely from adaptations to local environmental demands. These genetically encoded changes are expressed as characteristics that enabled their owners to be more reproductively successful than were those individuals who did not have them. Natural selection is plausible because it is a cumulative process that works step by step over many generations. Whereas design or blind chance imply that complex structures like the human eye or brain could have occurred all at once,

gradual accumulation of small adaptive changes requires no miraculous leaps.

To my knowledge no one—including Dawkins—has raised the question of whether more should be expected of an omnipotent designer than from natural selection. Writers of comic strips and science fiction have created characters with abilities far exceeding those possessed by people in the real world. A partial list of the abilities granted to fictional individuals includes the ability to fly, to see through and around objects, to be able to burst into flame, to have unlimited intelligence, to extend their limbs at will, and the like. Because of such powers, these storybook characters cope far better with the world than do ordinary people. An all-powerful deity with the ability to violate the laws of nature at will and to generate perfection all at once could have done at least as well when creating life forms.

How does a believer in an all-mighty designer explain deviations from ideals without reference to the impossibility of truly understanding the mind of an all-knowing deity? Maybe our proper challenge is to use our limited intelligence to try to figure out what the divine power had in mind. Dawkins mentions an Oxford theologian who claimed that the Holocaust was a gift from God because it allowed its victims the chance to display courage and nobility. Is that the proper model for understanding what looks like bad design?

Limitations in biological systems actually are not hard to understand. Natural selection implies nothing about ideals. The necessary variation may never have been present to be selected. If it did appear, it may have had disadvantages that outweighed its pluses. It might not have been heritable if it had ever occurred. It might have interfered with the solution of other problems in survival. An eye like a periscope would allow seeing all around, but it also might be easily damaged or destroyed. Would such a structure have interfered with finding food, surviving weather changes, and mating? Natural selection does not mean perfection in a given organ; it means being *good enough* to make a living in a demanding competitive environment. Possible reasons for imperfection at least have the potential for being investigated.

Natural selection generates evolutionary change or stability without any preconceived notion of what the species will become or

whether it will continue to exist. An element of randomness exists in the variations generated by genetic processes and in the nature of the current environment, that is, in the raw materials governing selection. In sum, natural selection generates complexity without any plan, goal, or design. Furthermore, ample data from both naturalistic observation and laboratory research show clearly that natural selection works. Can the same be said for the notions of creationism or intelligent design? What could possibly convince the proponents of those notions that they are wrong?

No one believes that we now know everything about evolution. Evolutionary biology is science, not dogma. Arguments or disagreements are not weaknesses, because they lead to further research. We learn if our ideas are wrong and then we adjust them to fit the hard data. For example, the theory of *punctuated equilibrium* (Eldredge, 1985; Eldredge & Gould, 1972) says that change in a species occurs in short periods (time being viewed in a geologic perspective, in which a million years is an instant) separated by long periods of stability. The supporting data have led to revised assumptions about the pace of evolution, but they cast no doubt on the validity of natural selection as the agent of both change and stability. It also may be true that natural selection often operates by screening variants that do not work rather than always by picking ones that do, but that really changes nothing.

THE UNIVERSALITY OF GOD THEORY

Belief in divinities appears in all known human cultures, though the specifics vary from one society to the next. However, even if everyone who ever lived believed in divinities, such would not prove that divine powers exist. After all, many once believed that the Earth was the center of creation or in a law that all bodies fall at a rate proportional to their weight. For evolutionists, though, any commonly found trait in a species is a candidate for having developed through natural selection. So, when humans show a characteristic (a phenotype in evolutionary terminology) as common as belief in divinity, Dawkins must take seriously the possibility that such beliefs are adaptive. He points out that religious activity consumes time and energy, can endanger the life of the individual, consumes

enormous resources, can lead to death, and can result in celibacy. What, then, could make the theistic phenotype sufficiently adaptive to balance out or overwhelm its negative aspects? If divinity theory did not offer some tangible advantage in coping with the challenges of life, it should have gone extinct long ago. As Dawkins says, even if neuroscientists find a part of the brain that causes belief in God, they still would not know why that center was advantageous in having grandchildren. The big question, then, is why genes that lead to religious belief would have spread.

Dawkins considers various lines of evidence. No convincing data support the claim that belief in a divinity protects people from contracting diseases, contributes to their cure, or reduces stress. Such data are not beyond the ability of scientists to obtain, but most efforts to date do not qualify as good science whether the results were positive or negative. The fact that Dawkins—a theorist who has often been thought of as *the* arch adaptationist—is dubious about an adaptive reason for a genetically coded belief in divinities, has not prevented others from inventing adaptive scenarios. Gould and Lewontin (1979) referred to the idea that every characteristic must be adaptive as the Panglossian paradigm, and the notion of universal adaptiveness finally seemed to have faded from sight. I would have thought that the kind of adaptationist storytelling that prevailed during the heyday of fanciful sociobiology would no longer be taken seriously. The excellent article by Robin Henig (2007) reviewing the various supposedly adaptive reasons for believing in divinities reveals that I am wrong. Perhaps the renaissance of human sociobiology in the guise of evolutionary psychology is the culprit.

Dawkins also rejects group selection—the idea that religion aids the species even if it may harm the individual—as a good explanation. Group selection is plausible in theory, but it has a major liability. Selfish individuals will benefit at the expense of the group and then their genes will replace those leading to group welfare. For example, individuals who avoid fighting for their country can profit from their lack of patriotism, especially if they fool others into thinking that they are dedicated patriots. The genes of these successful cheaters would be passed on to their descendants while those of the people killed in action would not be so

well favored. Because group selection is so sensitive to corruption, few evolutionary theorists believe in it.

We are left with the conclusion that a commitment to divinities was not the direct product of natural selection but instead a by-product of something else. This phenomenon was termed a *spandrel* by Gould and Lewontin (1979), and it was further elaborated in Gould's (2002) last book. An example of a spandrel is the orange color of carrots. The color probably itself is neither adaptive nor maladaptive; it is a byproduct of chemical factors that are important. A moth flying into a light bulb and burning up surely is not displaying adaptive behavior. More likely is that the moth's self-immolation is the byproduct of a visual system developed for using the moon and stars as means of localization at night. This compass is useful, but it has fatal results in an environment replete with nearby hot electric lights.

Dawkins thinks that the best way to understand the spread of God theory is to recognize that children evolved to learn from others. "Do what you are told to do." Children develop this phenotype, because a bias for it appearing under certain conditions is genetically encoded. Obedience was selected because of its great utility in avoiding predators, developing proper eating habits, and, usually, trusting what your parents and other adults tell or show you. This strategy works very well, but it also leads to the development of odd beliefs. In an essay published in 1993, Dawkins described a 6-year-old girl who wanted to grow up to be a tooth fairy. Many children write letters to Santa Claus. Because young children take literally what adults tell them or what they see on TV or in the movies, they wholeheartedly accept the reality of imaginary creatures. Gullibility has definite virtues for the still untutored young, but unquestioned obedience brings useless or even nonadaptive mental infections with it as well. Such thinking makes it easy to see why there are so many different religious beliefs depending upon the society in which one develops. A gene for Catholicism or Judaism or for being Moslem, Hindu, Buddhist, polytheist, or atheist, or for believing in Santa Claus or tooth fairies is not necessary. Given the appropriate environment, all that genetic expression needs is the possibility of a strong tendency during de-

velopment to learn from others. Everything else follows.

MOVING BEYOND DAWKINS

Where did the idea of a deity begin? How did the first God idea appear? To say that it was implanted by God is obviously completely circular. As is so often true, origins are difficult to figure out, much less to prove. Was it the gift of a fortunate mutation? Evolutionary biologists could believe that but only if the mutant with the resulting phenotype had adaptive advantages not shared by others missing the relevant gene. As described previously, Dawkins' discussion casts serious doubt on that idea. In any event, the notion is not testable by any scientific method known to me.

Daniel Dennett (2006) hypothesized that the initial cause for belief in a deity is an inherited tendency to attribute agency to other people, and to inanimate objects as well. He calls this *the intentional stance*. That, perhaps, leads readily to a starting point for mystical and other religious beliefs. Henig (2007) describes several other hypotheses offered to explain the sources of belief in divinities. Among these are what seem to be universal tendencies to believe in causality and to indulge in magical thinking. In his insightful review of Dennett's book, *Breaking the Spell*, Howard Rachlin (2007) raises compelling questions about the intentionality hypothesis. His convincing (to me) argument is that genetically based intentionality is a nonscientific idea that ignores the role of complex behavioral patterns influenced by the individual's environment and lifetime history. Rachlin describes Dennett's hypothesis as creationism moved from biological evolution to individual behavior. That same comment would apply to causal and magical beliefs and all of the other Jungian archetypes as well.

The essential point is that we simply do not know how God theory originated. I suggest that a place to start may be to recognize that all people encounter the same fundamental problems. A partial list includes how to understand birth and death, why accidents occur, why people become sick and why some recover whereas others do not, why crops sometimes succeed and sometimes fail, why we don't always win, why the weather sometimes

accords with our plans and sometimes does not, why tools that usually help us sometimes inflict damage. Other universal experiences include the feeling of awe encountered in considering the wonders of nature or the challenge of contemplating the mystery of what we do not understand. Inability to answer these questions causes some to hypothesize mystical forces and then to pass that hypothesis on to others. That is an economical way of understanding why all religions deal with the same issues but differ in their particulars without reference to any process other than a powerful tendency to learn from others. Even today we are often taught to ascribe human qualities to other animals and inanimate objects by our fairy tales, legends, movies, and TV shows. This could be a non-genetic explanation of how Dennett's intentional stance, or the attribution of causality, or a belief in magic is established in some people.

Those familiar with operant conditioning have long known that accidental contiguity between a response and a reinforcer can result in irrational behavior. However, I agree with Rachlin (2007) that what we know about superstition in laboratory experiments probably is not the answer to understanding the prevalence of religious belief. My reasons for questioning the role of adventitious reinforcement are different from his, because I believe that Skinner's (1948) demonstration and many others as well really have shown that accidental contiguities with reinforcers can strengthen arbitrary responses. The control of unusual and pointless responses by either fixed- or variable-time schedules of reinforcement has been a robust finding with humans of all ages and with other species as well (cf. Zeiler, 1972). The problem is that superstitious behavior is a transitory phenomenon: It occurs in the initial acquisition of behavior, but is rarely maintained in the steady state. Instead, the behavior drifts from one kind of response to the next, and finally tends to either dissipate or become the kind of species-specific activity that Staddon and Simmelhag (1971) observed.

Cognitive dissonance might account for why an irrational behavior is maintained even if the individual has experienced many failures of faith to produce desired outcomes. Still more likely is the possibility of devoutness coming to

be explicitly reinforced in both young children and adults. Some may learn that a particular religious identification can confer political, economic, and social advantages. In some situations skilled medical care is available only to those expressing certain religious beliefs. Winning a job or an election can be influenced by a candidate's avowed religion. Under some circumstances acting religious can be beneficial; in others it can be detrimental. The outcome may depend on the beliefs of the potential supplier of benefits. The possibilities are sufficiently varied as to either support existing belief systems or to result in their abandonment.

Child training being as variable as it is, we do not all share the same way of looking at things. Some people are educated to be religious and others not to believe in higher powers. Some are taught to think about the intentions of other people, animals, and inanimate objects. Others have not been taught that, for example, vegetables or clouds or animals are conscious entities showing self-directed motivated behavior. Some learn that not everyone is reasonable and so may have a cynical view of other people; some do or do not trust or even like animals. Learning produces both individual differences and similarities in ways of dealing with the world. What differs among individuals is what is learned.

THE BIGGER PICTURE

The task of evolutionary theory is to explain biological change, whether in the adaptation of one species to its environment, or in the appearance or disappearance of an entire species. Evolution refers to change, and biological evolution means changes in the genetic makeup of the population. Natural selection is based on the success or failure of phenotypes in coping with environmental demands. However, the science of genetics shows that phenotypes are not passed on to the next generation. What are passed on are the parents' genes that may control the expression of phenotypes, given an appropriate environment. Saying that selection is *for* phenotypes but *of* genes would be correct. Evolutionary biologists recognize that phenotypes do not depend on genes alone, but bias in that direction favors attributing altered phenotypes to changes in underlying genes.

Environmental influences on phenotypes tend to be acknowledged and then ignored.

Religion is not the only case where learning from others solves a problem dealt with in a less than satisfying manner by hypothetical genes. The following discussion—which does not appear in *The God Delusion*—explores another issue in evolutionary biology that may best be explained by genes promoting general learning strategies rather than by genes for specific responses or behavior patterns.

Consider the phenomenon of self-sacrifice for the benefit of others. Such altruistic activity has been documented in species ranging from insects to humans. The evolution of sterile worker castes among insects is altruistic because the workers sacrifice their ability to reproduce; the evolution of humans helping others at considerable expense (or even death) to themselves is well known. More examples are found in other species. Explaining altruism in any species raises the question of why it is adaptive to sacrifice one's own life and reproductive ability for the benefit of others. This phenomenon seems to cry out for an explanation about working for the good of the group rather than for oneself. However, group selection again confronts the success of cheaters. Selfish individuals can do very well in a system in which most others are dedicated to the welfare of the community. The faker's genes would be passed on at the expense of the genes for being altruistic, and these selfish genes eventually would come to predominate in the species.

Altruism was seen as a crucial problem for Darwinian theory and consequently generated intense scrutiny. The solution was to deny that true altruism ever occurs. Seeing how altruism has been handled requires a brief foray into modern evolutionary theory. Reproducing individuals contribute their share to the population gene pool, but the same endowment is made by other individuals who have the same genes. The *representation* of particular genes is independent of which individuals contributed them. William Hamilton (1964a, b) called this *inclusive fitness*. The importance of a gene in evolution depends not on one individual but on the total number of individuals that possess it.

Inclusive fitness has been used to explain altruism. If self-sacrifice produces more in-

stances of a particular gene appearing in the population than would individual reproduction, natural selection is operating to enhance altruism in the population. What this means then is that altruistic behavior should be confined to those with whom one shares genes—in short, to close relatives. If more of your genes are passed on to the next generation by behavior that allows many of your relatives to reproduce than by being a parent yourself, then such behavior will prevail. This account works well to explain the evolution of sterile insect castes and other forms of altruism that do not seem to stem from choices made by individuals.

More voluntary forms of self-sacrifice require additional premises. One is the idea that altruism must be confined to relatives based on their familial closeness. Because parents, siblings, and children on average contain more of the same genes than do grandchildren and cousins, altruism is more likely directed at the first group than the second. Move further down the scale of genetic relatedness—self-sacrifice would be more likely to occur for grandchildren than for cousins, and for cousins than for strangers. Very few would sacrifice themselves for a member of an unrelated family. Those familiar with popular culture might see this as a genetically framed version of what might be called the Godfather Principle of self-sacrifice.

Nothing so far explains the many observations of altruism to nonrelatives. To fill this gap, theorists say that altruism to unrelated others might occur given some reason to expect that self-sacrifice would be reciprocated. That would help explain why altruism might be directed at a spouse or a spouse's family or perhaps even to another genetically unrelated individual. *From the gene's point of view, altruism is always selfish!*

The strength of this account is that it solves the problem of how natural selection theory can explain self-sacrifice in terms of genetics without adding such ideas as group selection. But the account does not fit the available data. Inherent in the explanation is that one can discriminate relatives from nonrelatives and can tell those who are likely to reciprocate from those not likely to return the favor in the future. Little evidence supports the idea that genetic relatedness is discriminated in and of itself. The positive data are confounded with

the recognition of close relatives when the related individuals lived together during development. Nevertheless, this is the prevalent view of altruism among those evolutionary theorists who write and talk about it.

There is an alternative explanation of self-sacrifice. Herbert Simon (1990) hypothesized that human altruism is the product of social learning. Humans are taught from birth to behave in certain ways toward others. Sometimes children are taught to behave differently to relatives and non-relatives or to be open with friends and more withdrawn with strangers. Sometimes they are taught general principles of good citizenship. If we are genetically programmed with a tendency to learn from others, then this early teaching will result in self-sacrifice that benefits relatives, friends, unrelated people, and even members of different species. This alternative resolves the conceptual issues mentioned above. It is not necessary to discriminate kin from others if children have learned the rules of dealing with others. We call it socialization.

The kind of social learning referred to now involves the transfer of belief systems across individuals. Learning from others occurs in a variety of ways. For example, people may shape the social behavior of others; usually, they are likely to reinforce the behaviors they desire in others. Sometimes those in authority impose consequences for conformity or non-conformity to rules. Teachers usually try to produce desired behavior by giving instructions. They may add some form of avoidance and escape conditioning and punishment as well to overcome reluctance or deviations from desired outcomes. Most likely social learning typically involves a combination of contingencies. We already know a great deal about shaping, but we understand the role of instructions in generating new behavior less well. Also, we cannot overlook the important role played by imitation of what others do. Imitative learning is not unique to humans. An extensive series of experiments by Galef and his colleagues (see Galef, 1996, for a review) has shown that rats choose their diets based on signals from other members of their species. Many other examples of individuals learning what to do from other members of their species exist as well. A partial list includes cultural transmission of vocal behavior in some species of birds (e.g., Marler & Tamura, 1964),

tool use in chimpanzees (McGrew, 1992), foraging in pigeons (Giraldeau, Caraco, & Valone, 1994; Zentall, Sutton, & Sherburne, 1996) and rats (Terkel, 1995), and fear responses by monkeys (Mineka & Cook, 1988). The prevalence of imitative learning implies a cross-species genetic predisposition for such behavior to develop.

Experimental laboratories as well as applied settings have taught us much about how simple and complex contingencies influence and determine behavior. An important next step is to have equivalent information about the many forms that *social learning* takes so that we move beyond simply documenting it to understanding its basic processes. Several studies referenced above have made a beginning in investigating the role of such factors as number of demonstrators, number of learners, and the availability of alternative strategies in controlling how well an individual copies what others do. Generalized imitation (imitating anything done by a model) can be developed readily if it happens not to occur spontaneously (e.g., Baer & Sherman, 1964). Much more is needed. Don Hake (e.g., Hake, Donaldson, & Hyten, 1983) published papers on cooperation and competition in this journal. In 1978, he and Olvera pled for more experimental attention devoted to social behavior, but the plea has not been followed by many papers in *JEAB*. Perhaps the principles of nonsocial and social learning are similar; perhaps they are not; perhaps language generates different processes. We need to find out. Polemics will never give us the answers we so badly need.

The God Delusion extends Dawkins' theory of cultural evolution to the role played by learning in producing the varieties of religious and antireligious belief. He has argued persuasively that such behavior cannot be understood solely by reference to genetics. God theory is fraught with strong opinions and convictions both pro and con, but he shows us clearly and emphatically that it is likely the result of training and deliberate teaching and generalized imitation as well. Implicit in his message is that subsequent experiences result in new learning that may either confirm or dispute what we were first taught to believe. Some keep their beliefs; others change them.

The acquisition and maintenance of myriad patterns of behavior in us and other organisms

are far more important than has usually been recognized by most evolutionary theorists. Biological evolution has given living species the ability to learn and general strategies for doing so, but it does not say how these rules are implemented in the way organisms deal with their environments. Nor does biological evolution explain what is learned and exactly how and when that learning occurs. To say that biological and cultural evolution are analogous processes is not to explain the mechanisms by which cultural evolution occurs, and to attribute behavior to culture is to pose the problem of understanding both its mechanisms and its development.

Surely this is not news to readers of this journal. Those convinced of the important role that learned behavior plays in life should appreciate what Dawkins has done in using it to explain a phenomenon as widespread and controversial as belief in divinities. Genetics enables certain kinds of behavior; behavioral research and theory provide the principles by which behavior, including religious belief, is acquired, maintained, and extinguished. A complete evolutionary biology must understand the learning strategies that allow individuals to cope with the problems of making a living in a demanding world and to pass their knowledge on to others.

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